The role of tapping in improving connected speech comprehension of a non-native variety of English

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Introduction

Comprehension of Glaswegian English is difficult for speakers of other varieties of English (Adank et al., 2009; Smith et al., 2014). In fast casual speech, weak syllables get particularly reduced, which increases the chances of miscomprehension even further.

Tapping, or engaging in a synchronized motor task while listening to an external stimulus, can be a means of entrainment with speech (Lidji et al., 2011).

Research question

Can tapping to the beat in rhythmically regular speech help listeners to adapt to an unfamiliar variety of English?

Hypothesis

Performing a tapping task with unfamiliar Glaswegian-accented speech will lead to stronger entrainment than a control (click identification) task.

Assumption: greater entrainment will lead to greater improvement on a speech comprehension task focused on weak syllables

Therefore: Participants who perform a tapping task will improve comprehension more than controls.

Method

Participants

40 native speakers of Canadian or US English; living in Montreal, Canada; 22 F, mean age 22.5, 11 were bilingual, all English dominant

Experiment Structure

Pre-test

Hear sentences and fill in gaps, e.g.:

But it sat _____ path _____ duck.

Answer: But it sat **on the** path **of the** duck.

Training Phase

Hear sentences, and either

Tapping Tap to the beat heard in speech	**Click Identification** (control) Tap upon hearing a click

Post-test

Same task as pre-test with new sentences

Materials

- Simple sentences with a regular metrical structure (e.g. But it sat **on the** path **of the** duck.)
- Weak syllables were function words that undergo reduction (Hagen 2000); designed so that there could be ambiguity as far as the meaning is concerned
- Produced by a male speaker of Glasgow English, at 2 rates (slow=80, fast=160 bpm), cued by a metronome.

Procedure

Training Phase: Listeners heard sets of 4 repetitions of 38 sentences, 1 x slow + 3 x fast rate. They performed task (tapping/click ID) on the last two fast tokens.

Pre-/Post-test: 20 sentences in each test (different sentences in pre-, post- and training). 1 token of each sentence, spoken at a fast rate.

Analysis of Pre- and Post-Test

Each missing word coded as correct or incorrect.

Logistic regression in R, starting with all main effects, incrementally removing n.s. variables and testing interactions (looking for significance and low BIC).

Dependent Variable: Score (0 or 1)

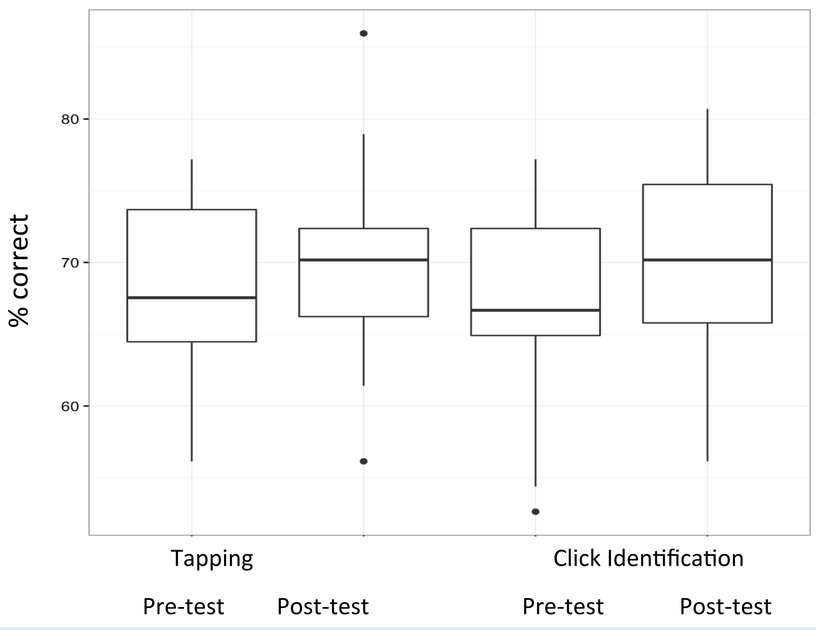
Fixed Effects: (**bold** = retained in final model):

Test (Pre/Post); **Type of function word; Self-reported ability to tap to a beat** – scale 1-5 (correlated with other variables e.g. years of musical training); Training condition (Tapping vs Click ID); Languages known; Interaction of **Test** x **Self-reported ability to tap on beat**

Random effects: **Participant, Trial Number**

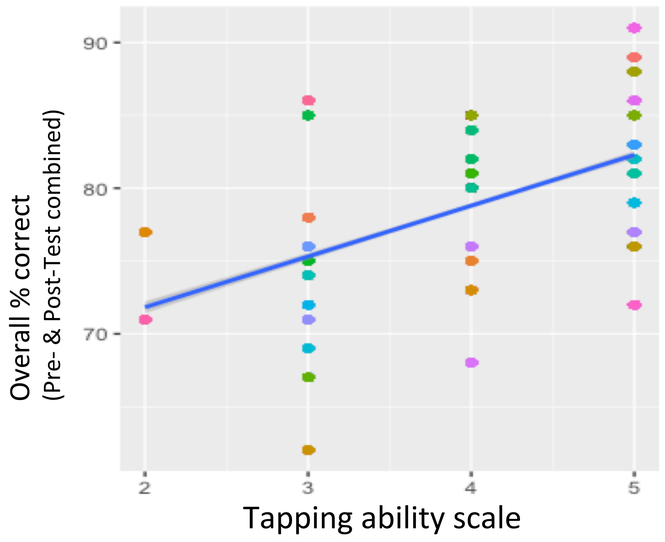
Results – Pre-Test & Post-Test

1. Trend for improvement from pre- to post-test:

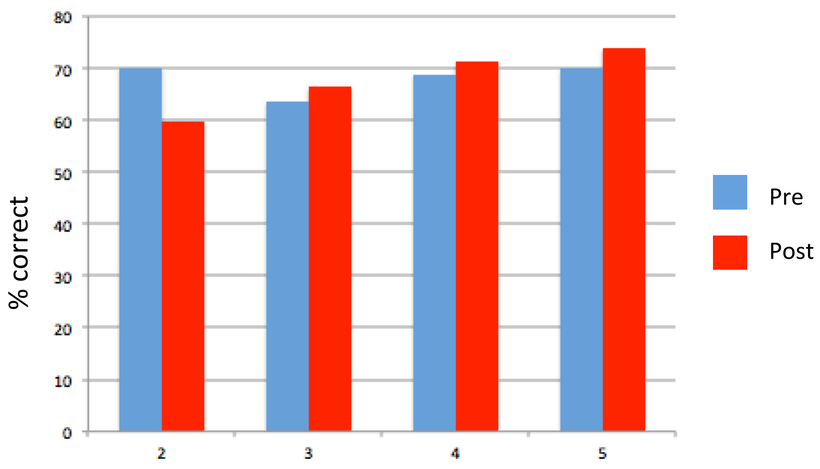


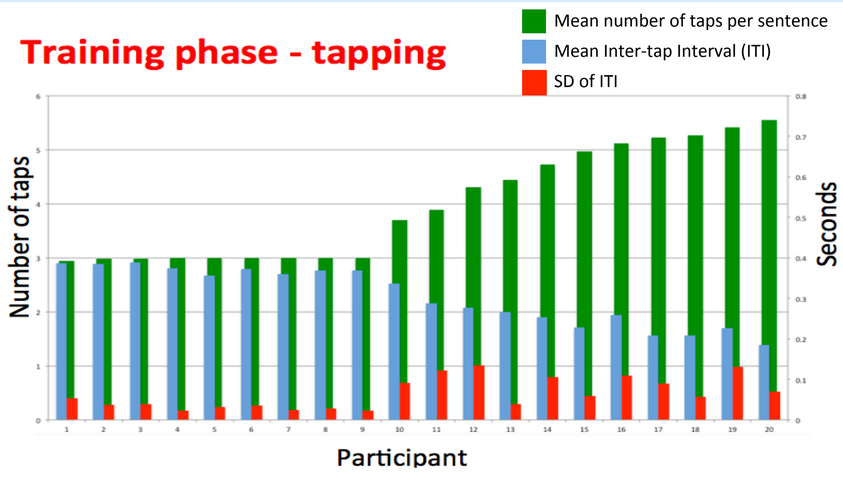
2. Significant main effect of type of function word: some types less intelligible than others ($p < 0.05$)

3. Significant effect of self-reported tapping ability ($p < 0.0005$); i.e. better scores overall if better tapping ability

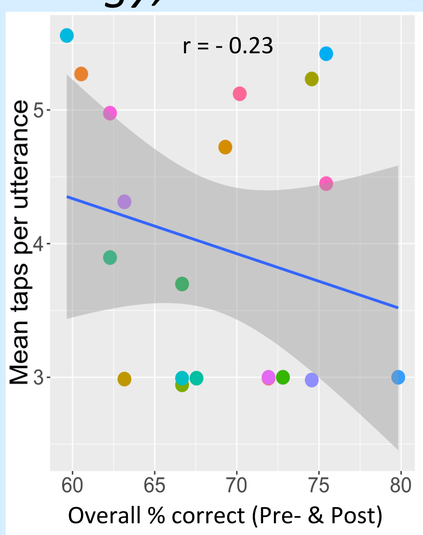


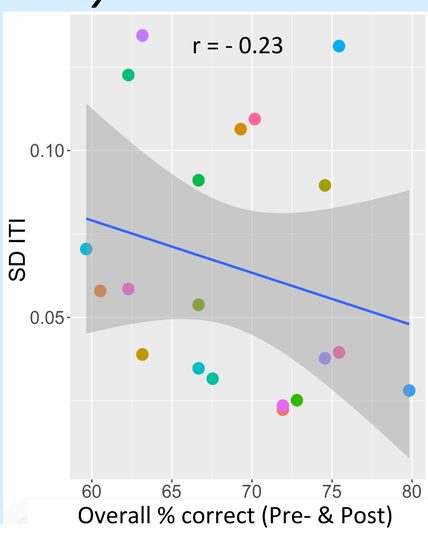
4. Marginally significant interaction ($p = 0.08$) between Test (Pre/Post) and Self-reported tapping ability: Poor self-reported tappers get worse at task, while good tappers tend to improve.





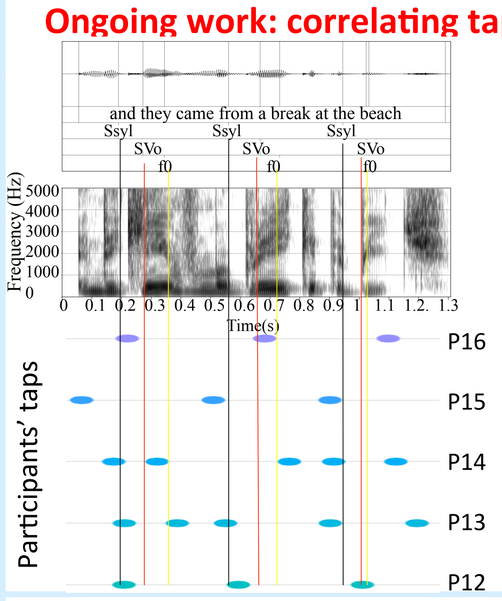
1. About half of the participants tapped 3 times per sentence, i.e. once per stressed syllable.
2. These are the participants with the smallest SDs & most stable ITI means.





Poorer tappers (those who tapped more times per sentence and had more variable ITIs) tended to have worse intelligibility scores in pre- and post-test

Ongoing work: correlating taps & speech



We are exploring relationships between recorded tap timings & key events in speech signal (**Ssyl** =stressed syllable onset, **SVo**=stressed vowel onset, **f0**=f0 peak).

Even regular tappers seem to vary in which events they align with (compare Ps 16, 15, 12).

Conclusions & future work

1. Training involving tapping did not improve listeners' comprehension more than control training involving click identification. Indeed, there was limited evidence of improvement in either training condition.

However…

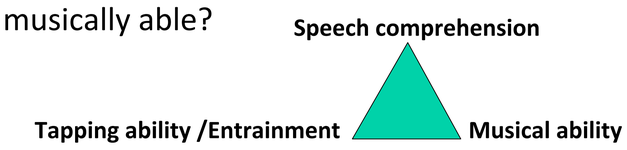
2. Musical ability, as represented by the self-reported tapping ability variable, had a positive effect on the Canadian/US listeners' comprehension of function words produced by a Glaswegian English speaker.
3. Musical ability was weakly linked to improvement in comprehension from pre- to post-test.
4. Subjects who tapped more regularly in the tapping condition tended to have higher comprehension scores.

Therefore:

Musical ability is linked to ability to entrain to the beat in speech. Musical ability is also linked to comprehension of a non-native variety of English, and (weakly) to improvement in comprehension after hearing rhythmic speech.

Although short-term training involving tapping did not provide a direct benefit (compared to control training), the tapping task revealed relationships between speech comprehension and music which merit further investigation.

Might training involving tapping be more beneficial to comprehension for those subjects who are more musically able?



This experiment is a part of a bigger project. It will be conducted on two more listener groups: EFL learners and native Glaswegians. The broader aim is to develop a method of teaching English connected speech to EFL learners using rhythmic methods, e.g. tapping.

References: Adank, P, Evans BG, Stuart-Smith, J, Scott, Sophie K. (2009) Comprehension of familiar and unfamiliar native accents under adverse listening conditions. *Journal of Experimental Psychology: Human Perception and Performance, Vol 35*(2), Apr 2009, 520-529. Smith, R, Holmes-Elliott, Pettinato, M., and Knight, R.-A. (2014). Cross-accent intelligibility of speech in noise: Long-term familiarity and short-term familiarization. *Quarterly Journal of Experimental Psychology* 67(3), 590-608. Lidji, P., Palmer, C., Peretz, I. Morningstar, M. (2011). Listeners feel the beat: Entrainment to English and French speech rhythms. *Psychon Bull Rev,18*(6):1035-41.